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ORIGINAL

FLOOD INSURANCE STUDY

COMPLETED

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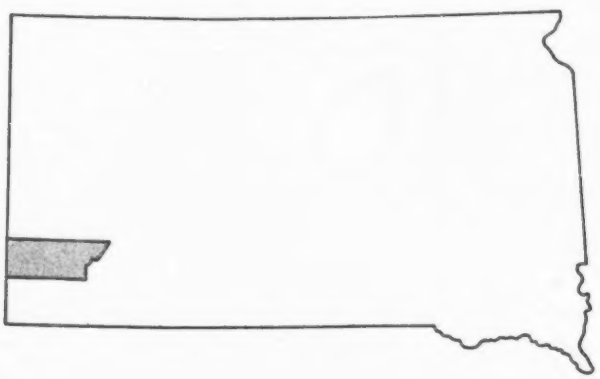
CUSTER COUNTY, SOUTH DAKOTA
UNINCORPORATED AREAS



SEPTEMBER 29, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 460018

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Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the unincorporated areas of Custer County, South Dakota, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), Omaha District, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-E-1153, Project Order No. 1, Amendment No. 27. This study was completed in January 1985.

1.3 Coordination

An initial coordination meeting was held in the City of Custer on July 18, 1983. Representatives from the study contractor, the State Emergency and Disaster Service, the City of Custer, and Custer County were in attendance.

Coordination was made with the U.S. Geological Survey (USGS), the U.S. Bureau of Reclamation, the U.S. Soil Conservation Service, the South Dakota Department of Military and Veteran Affairs - Division of Emergency and Disaster Service, the South Dakota Department of Agriculture, Southwestern Civil Preparedness District, and Custer County relative to obtaining information pertinent to the study.

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The final community coordination meeting was held on October 30, 1985, and attended by representatives of FEMA, the study contractor, and the community. All problems and concerns raised at that meeting have been addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Custer County, South Dakota. The area of study is shown on the Vicinity Map (Figure 1).

The City of Custer and the Towns of Hermosa, Pringle, Buffalo Gap, and Fairburn are not included in this study.

Detailed analyses were made of Battle Creek, French Creek, Grace Coolidge Creek, and Laughing Water Creek. French Creek was studied from a point approximately 1.1 miles upstream from U.S. Highway 16 along Upper French Creek Road downstream to the corporate limits of Custer. Downstream of the City of Custer, French Creek was also studied from the corporate limits to a point approximately 0.2 mile upstream from Stockade Lake. Laughing Water Creek was studied from the corporate limits of Custer upstream for a distance of 0.8 mile. Battle Creek was studied from a point approximately 2.2 miles downstream from the Chicago and North Western Railroad to a point approximately 2.3 miles upstream from the confluence of Grace Coolidge Creek. Grace Coolidge Creek was studied from its mouth to a point approximately 2.3 miles upstream from State Highway 36.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through 1990.

2.2 Community Description

Custer County, located in southwestern South Dakota, is in the heart of the Black Hills. The City of Custer, the county seat, is located approximately 40 miles southwest of Rapid City. Custer County is bordered on the north by Pennington County, on the east by Shannon County, and on the south by Fall River County, South Dakota. To the west lie Niobrara and Weston Counties, Wyoming.

According to U.S. Census Bureau, the population of Custer County increased from 4,698 in 1970 to 6,000 in 1980 (Reference 1).

The topography of the area consists of the distinctive outcrop known as the Black Hills. The crystalline core of the uplift, bared by erosion, ranges from an elevation of 5,280 feet mean sea level (msl) to 6,800 feet msl in Custer County. The soils of the

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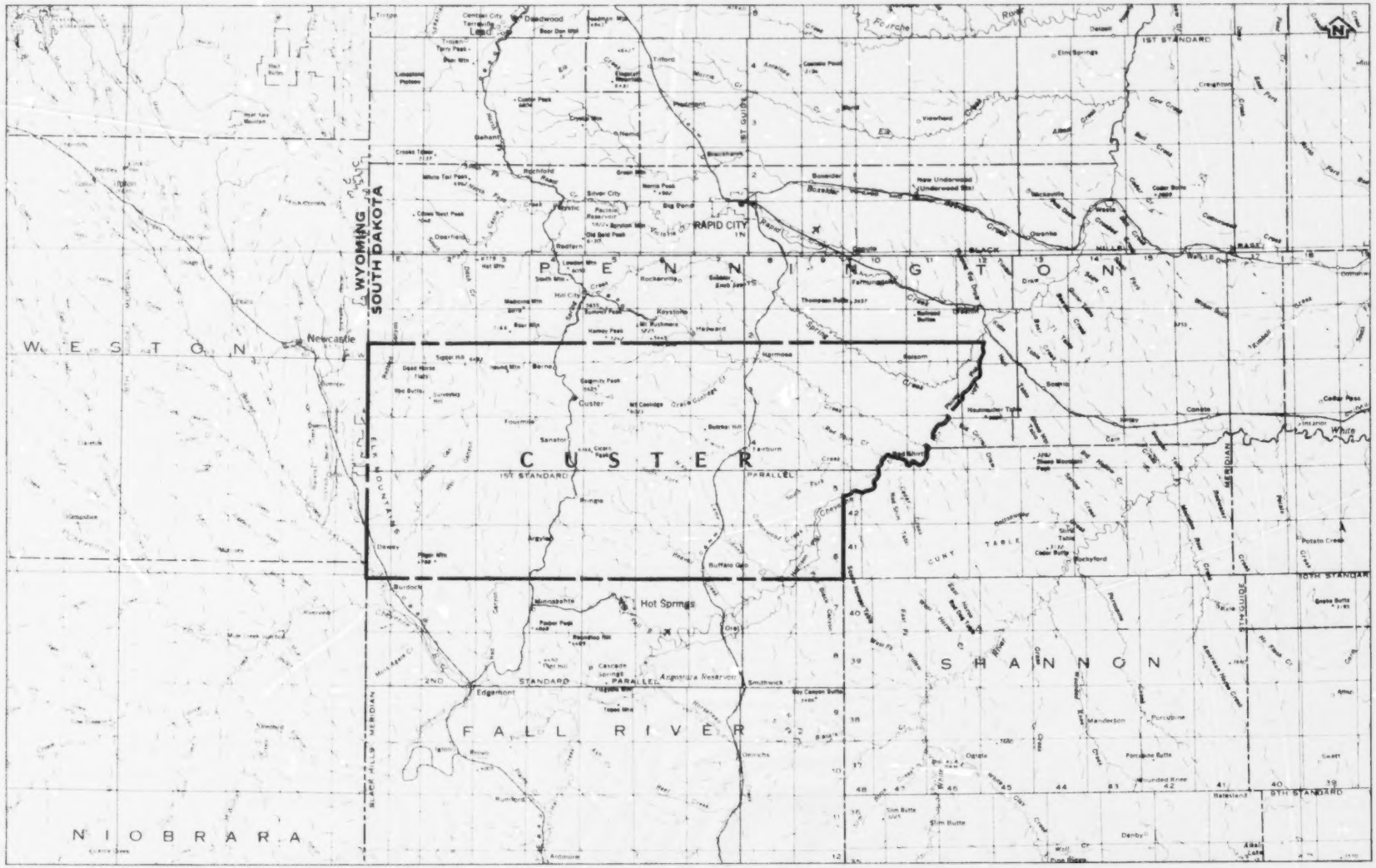

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

16 0 16 32 48 MILES

VICINITY MAP

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area are generally formed from the weathering of underlying rock. The most extensive soils are the sandy, silty, and clay loams (Reference 2).

French Creek flows from west to east through the center of the City of Custer, and has a drainage area of 67.4 square miles downstream from Custer near Stockade Lake. Laughing Water Creek flows from the north and joins French Creek just outside the eastern corporate limits of the City of Custer. Its drainage area is 5.9 square miles. Battle Creek flows southeasterly from the central Black Hills along the south side of the Town of Hermosa, and has a drainage area of 178 square miles at the USGS gage station near Hermosa. Grace Coolidge Creek flows northeasterly to its confluence with Battle Creek west of the Town of Hermosa. Its drainage area is 59.6 square miles.

The basic industry in Custer County is tourism. Other industries in the area are mining and agriculture.

The climate in the Custer County area of the Black Hills differs markedly from the climate of the surrounding plains. Although precipitation and average temperatures are higher in the City of Custer, extremes in precipitation and temperature are greater in the outlying plains. The average annual temperature in the City of Custer is approximately 46°F, and the average annual precipitation is approximately 18 inches. The average annual precipitation in the Town of Hermosa is approximately 17 inches. Maximum precipitation occurs in May and June. The greatest amount of precipitation occurs as rain in the spring and early summer (Reference 3).

2.3 Principal Flood Problems

Past floods have been caused by the runoff from heavy general rains or intense local rains. The most damaging floods have occurred during May and June. Significant flooding occurred in May 1946, June 1947, May 1952, and June 1972. All of these floods destroyed or weakened county bridges on both French and Battle Creeks. The worst flood, that of June 1972, caused $250,000 damage to Custer County roads. The estimated discharge on Battle Creek at the USGS gage south of Hermosa was 21,400 cubic feet per second (cfs) in June 1972. This flood was somewhat less than the 100-year flood.

2.4 Flood Protection Measures

There has been some channelization within the City of Custer along French Creek; however, this has had no effect on flooding in Custer County. No flood protection structures have been constructed upstream from or within the study reaches.

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3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The discharge-frequency data for French Creek and Laughing Water Creek were defined using the results of a regional analysis conducted by the COE for Rapid City, South Dakota (Reference 4). The watershed characteristics of this area are similar to those at Custer. The base regional data were then used in a log-Pearson Type III analysis to develop specific regional flood discharge-frequency relationships.

The discharge-frequency data for Battle Creek and Grace Coolidge Creek were developed from a regional frequency analysis of peak flows at the USGS gaging station on Battle Creek near Hermosa. Snyder's 1-hour unit hydrographs were developed at the location of interest using the constants $C_t = 0.58$ and $C_p = 1.30$ discussed in the Rapid City study (Reference 4).

The ratios of the unit hydrograph peaks were used to apply the results of the frequency analysis at the gaging station to the other locations on Grace Coolidge Creek and Battle Creek.

Peak discharge-drainage area relationships for French Creek, Laughing Water Creek, Grace Coolidge Creek, and Battle Creek are shown in Table 1.

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Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
French Creek					
Above Custer	32.4	610	2,850	5,370	21,060
At Custer Above Junction With Laughing Water Creek	39.7	710	3,330	6,260	24,570
At Custer Below Junction With Laughing Water Creek	45.6	780	3,670	6,900	27,060
Below Custer Near Stockade Lake	67.4	1,040	4,920	9,260	36,340
Laughing Water Creek					
At Custer	5.9	180	850	1,590	6,240
Grace Coolidge Creek					
Above Hermosa	59.6	800	4,990	10,360	52,340
Battle Creek					
Above Hermosa	103.0	1,410	8,790	18,250	92,220
At Hermosa Below Junction With Grace Coolidge Creek	175.2	2,130	13,250	27,510	138,990

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3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Water-surface elevations for the 10-, 50-, 100-, and 500-year floods were computed using the COE standard HEC-2 step-backwater computer program (Reference 5).

Stream cross sections and bridge data were obtained by field surveys (References 6 and 7). Additional bridge data were obtained by the COE through field measurements. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Roughness coefficients (Manning's "n") were based on data obtained from the South Dakota USGS office, field inspection, engineering judgment, and the USGS stream-gaging station at Hermosa. These values are summarized in Table 2.

Starting water-surface elevations on Laughing Water Creek and French Creek, upstream from the City of Custer, were obtained from the City of Custer Flood Insurance Study (Reference 3).

Starting water-surface elevations on French Creek, downstream from the City of Custer, and on Battle and Grace Coolidge Creeks were computed at normal depth.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

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Table 2. Summary of Roughness Coefficients

Stream	Main Channel "n"	Flood Plain Overbank "n"
Battle Creek	0.026-0.045	0.050-0.070
French Creek	0.035-0.100	0.030-0.050
Grace Coolidge Creek	0.050-0.080	0.050
Laughing Water Creek	0.055-0.065	0.040-0.060

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4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000, with contour intervals of 20 and 40 feet (Reference 8).

The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). These boundaries were verified by comparing past flood photographs and previous studies (Reference 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year flood plain boundary is shown.

Approximate 100-year flood plain boundaries in some portions of the study area were taken directly from the Flood Hazard Boundary Map (Reference 9).

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were initially computed on the basis of equal conveyance reduction from each side of the flood

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plain. At certain cross sections, the amount of encroachment was adjusted to smooth the boundaries of the floodway. In addition, the floodway width at cross sections with excessively high velocities was widened to the 100-year boundary. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 3).

The floodways computed do not consider the effects of ice on the rivers.

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

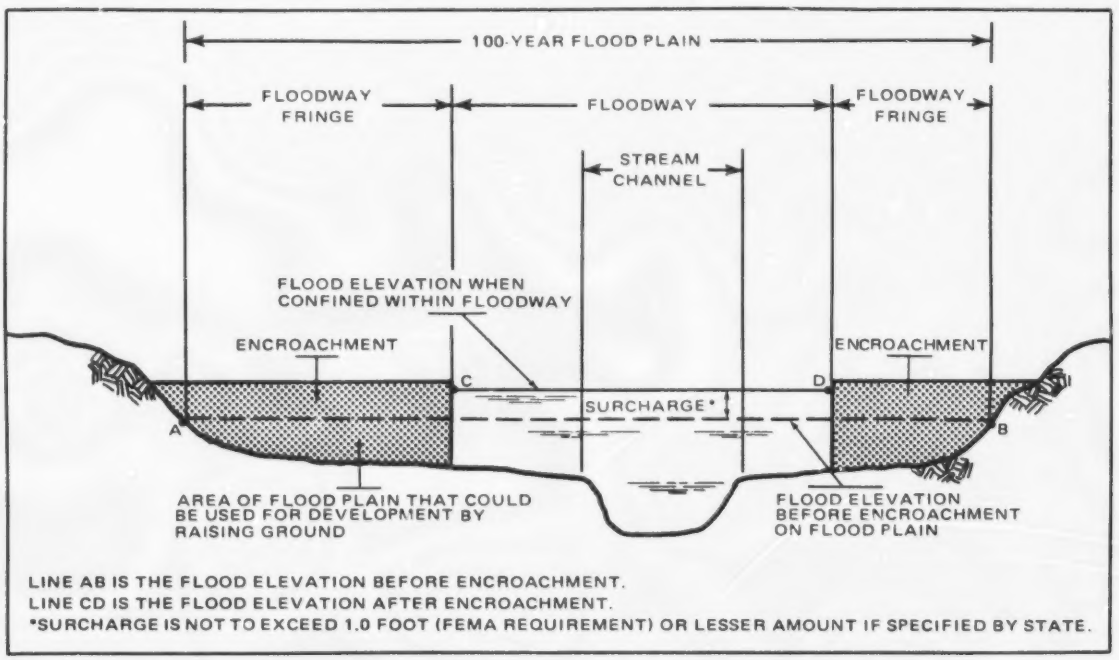
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 2. Floodway Schematic

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
Battle Creek								
A	240,700	1,686	12,135	2.3	3,271.0	3,271.0	3,272.0	1.0
B	246,230	985	3,636	7.6	3,280.8	3,280.8	3,280.8	0.0
C	248,160	1,025	5,406	5.1	3,288.0	3,288.0	3,288.2	0.2
D	251,820	2,399	10,822	2.5	3,292.0	3,292.0	3,292.8	0.8
E	255,350	1,638	5,830	4.7	3,300.9	3,300.9	3,301.3	0.4
F	258,550	900	4,891	5.6	3,307.5	3,307.5	3,307.8	0.3
G	260,840	965	5,655	4.9	3,317.4	3,317.4	3,317.4	0.0
H	266,320	628	2,921	9.4	3,329.9	3,329.9	3,330.3	0.4
I	269,020	480	2,446	7.5	3,340.1	3,340.1	3,340.9	0.8
J	271,430	365	1,916	9.5	3,351.6	3,351.6	3,351.9	0.3
K	273,100	600	4,392	4.2	3,358.7	3,358.7	3,359.2	0.5
L	274,880	496	3,335	5.5	3,365.6	3,365.6	3,365.7	0.1
M	276,170	313	2,909	6.3	3,375.8	3,375.8	3,375.8	0.0
N	277,300	543	3,850	4.7	3,376.7	3,376.7	3,377.4	0.7
O	280,160	464	2,418	8.6	3,391.4	3,391.4	3,391.4	0.0

[1]Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

FLOODWAY DATA

BATTLE CREEK

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
French Creek								
A	31,844	120	897	10.3	5,180.7	5,180.7	5,181.3	0.6
B	32,624	250	2,497	3.7	5,190.7	5,190.7	5,190.7	0.0
C	33,634	115	1,342	6.7	5,191.0	5,191.0	5,191.1	0.1
D	34,064	205	1,659	5.4	5,195.7	5,195.7	5,195.7	0.0
E	34,954	212	1,265	7.0	5,200.0	5,200.0	5,200.0	0.0
F	35,279	170	1,318	6.7	5,201.3	5,201.3	5,201.3	0.0
G	36,079	160	845	10.3	5,204.9	5,204.9	5,205.2	0.3
H	36,789	90	863	10.0	5,211.9	5,211.9	5,212.8	0.9
I	38,209	325	1,416	6.0	5,215.9	5,215.9	5,216.3	0.4
J	38,739	64	753	11.2	5,223.2	5,223.2	5,223.2	0.0
K	40,259	100	783	10.5	5,228.4	5,228.4	5,229.1	0.7
L	41,409	155	1,079	7.5	5,234.6	5,234.6	5,235.3	0.7
M	43,159	175	1,154	6.8	5,243.7	5,243.7	5,244.6	0.9
N	44,459	240	1,347	5.7	5,248.8	5,248.8	5,249.7	0.9
O	44,969	230	1,455	5.3	5,252.8	5,252.8	5,253.1	0.3
P	45,899	390	3,535	2.1	5,262.0	5,262.0	5,262.0	0.0
Q	47,409	255	1,057	7.0	5,263.6	5,263.6	5,264.2	0.6
R	48,229	315	1,611	4.5	5,269.8	5,269.8	5,270.7	0.9
S	49,259	230	1,069	6.5	5,272.8	5,272.8	5,273.7	0.9
T	50,244	260	913	7.7	5,279.9	5,279.9	5,280.0	0.1
U	50,644	330/120[2]	1,315	5.3	5,281.9	5,281.9	5,282.7	0.8
V	61,390	149	790	7.7	5,340.5	5,340.5	5,340.5	0.0
W	61,850	255	1,205	5.1	5,344.2	5,344.2	5,344.2	0.0
X	62,435	280	706	8.6	5,351.4	5,351.4	5,351.4	0.0
Y	63,845	230	1,740	3.4	5,358.3	5,358.3	5,358.3	0.0
Z	64,895	162	847	6.9	5,359.6	5,359.6	5,360.2	0.6

[1]Feet Above Mouth [2]Width/Width in County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

FLOODWAY DATA

FRENCH CREEK

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
French Creek (Cont'd)								
AA	65,905	325	2,311	2.5	5,368.0	5,368.0	5,368.7	0.7
AB	66,430	140	580	9.9	5,369.6	5,369.6	5,370.0	0.4
AC	67,425	198	669	8.5	5,376.9	5,376.9	5,376.9	0.0
AD	68,295	210	1,799	3.1	5,389.5	5,389.5	5,390.4	0.9
AE	69,165	160	833	6.7	5,395.5	5,395.5	5,395.5	0.0
AF	69,765	109	690	8.0	5,397.8	5,397.8	5,398.5	0.7
AG	70,875	135	925	5.9	5,411.9	5,411.9	5,412.0	0.1
AH	71,355	73	712	7.6	5,416.4	5,416.4	5,417.4	1.0
AI	71,805	50	418	12.9	5,418.1	5,418.1	5,418.9	0.8

[1]Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

FLOODWAY DATA

FRENCH CREEK

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
Grace Coolidge Creek								
A	0[1]	885	3,264	3.2	3,336.0	3,334.9[2]	3,335.9[2]	1.0
B	3,900[1]	584	1,361	7.6	3,350.8	3,350.8	3,350.9	0.1
C	5,820[1]	842	2,391	4.3	3,358.6	3,358.6	3,358.7	0.1
D	8,270[1]	546	1,451	7.1	3,366.1	3,366.1	3,366.3	0.2
E	10,000[1]	580	2,522	4.1	3,378.9	3,378.9	3,378.9	0.0
F	12,000[1]	643	1,273	8.1	3,387.0	3,387.0	3,387.0	0.0
G	13,350[1]	343	1,582	6.5	3,392.7	3,392.7	3,393.0	0.3
H	14,900[1]	169	1,136	9.1	3,400.7	3,400.7	3,401.1	0.4
I	16,110[1]	117	1,118	9.3	3,407.9	3,407.9	3,407.9	0.0
J	17,610[1]	173	1,352	7.7	3,413.7	3,413.7	3,414.3	0.6
K	19,020[1]	285	1,419	7.3	3,425.4	3,425.4	3,425.4	0.0
L	21,180[1]	402	1,606	6.4	3,437.8	3,437.8	3,438.8	1.0
M	21,900[1]	250	1,294	8.0	3,444.4	3,444.4	3,445.2	0.8
Laughing Water Creek								
A	3,585[3]	150	351	4.5	5,339.0	5,339.0	5,339.0	0.0
B	4,235[3]	100	211	7.5	5,346.6	5,346.6	5,346.6	0.0
C	4,735[3]	19	114	14.0	5,363.5	5,363.5	5,364.3	0.8
D	5,435[3]	70	231	6.9	5,379.0	5,379.0	5,379.8	0.8
E	6,135[3]	130	258	6.2	5,390.7	5,390.7	5,390.8	0.1
F	7,010[3]	128	282	5.6	5,402.3	5,402.3	5,402.9	0.6
G	7,810[3]	59	173	9.2	5,415.4	5,415.4	5,415.6	0.2

[1]Feet Above Confluence With Battle Creek [2]Elevation Computed Without Consideration of Backwater From Battle Creek [3]Feet Above Confluence With French Creek

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

FLOODWAY DATA

GRACE COOLIDGE CREEK-LAUGHING WATER CREEK

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5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting Custer County.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of Custer County are shown on the Flood Profiles (Exhibit 1) and summarized in Table 4.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Battle Creek							
Reach 1	0085	-7.0	-1.7	4.8	070	A14	Varies - See Map
Reach 2	0085	-5.2	-1.4	5.4	050	A10	Varies - See Map
Reach 3	0085	-4.4	-1.6	5.8	045	A9	Varies - See Map
Reach 4	0085	-6.4	-2.4	7.4	065	A13	Varies - See Map
Reach 5	0085	-3.8	-2.1	11.7	040	A8	Varies - See Map
Reach 6	0085	-8.5	-3.6	12.2	085	A17	Varies - See Map
Reach 7	0085	-5.7	-2.3	8.6	055	A11	Varies - See Map
French Creek							
Reach 1	0065	-7.5	-1.8	5.1	075	A15	Varies - See Map
Reach 2	0065	-5.7	-1.9	6.2	055	A11	Varies - See Map
Reach 3	0065	-7.0	-3.0	7.4	070	A14	Varies - See Map
Reach 4	0065	-5.2	-1.8	6.2	050	A10	Varies - See Map
Reach 5	0065	-7.0	-3.0	5.0	070	A14	Varies - See Map
Reach 6	0065	-4.9	-1.6	4.9	050	A10	Varies - See Map
Reach 7	0065	-7.2	-1.3	3.4	070	A14	Varies - See Map
Reach 8	0065	-3.8	-1.1	3.7	040	A8	Varies - See Map
Reach 9	0065	-6.8	-3.2	4.0	070	A14	Varies - See Map
Reach 10	0065,0045	-4.7	-1.6	4.8	045	A9	Varies - See Map
Reach 11	0045	-4.1	-1.7	5.8	040	A8	Varies - See Map
Reach 12	0045	-6.1	-2.5	7.4	060	A12	Varies - See Map
Grace Coolidge Creek							
Reach 1	0085	-3.9	-1.4	3.9	040	A8	Varies - See Map
Reach 2	0085	-6.1	-2.4	4.0	060	A12	Varies - See Map
Reach 3	0085	-7.0	-2.5	6.5	070	A14	Varies - See Map
Laughing Water Creek							
Reach 1	0065	-2.4	-0.8	2.8	025	A5	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

BATTLE CREEK-FRENCH CREEK-GRACE COOLIDGE CREEK-LAUGHING WATER CREEK

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Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A5, A8-A15, and A17:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other local water-control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flood hazard; not subdivided.

The flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 4.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Custer County is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the NFIP.

6.0 OTHER STUDIES

Flood Insurance Studies have been prepared for the City of Custer (Reference 3) and for Pennington County, South Dakota (Reference 10). This study is in general agreement with the Pennington County Flood Insurance Study; however, because of up-to-date information, this study does not match that of the City of Custer.

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Fall River and Shannon Counties, South Dakota; Niobrara and Weston Counties, Wyoming; and the Towns of Buffalo Gap, Fairburn, Hermosa, and Pringle are not participating in the NFIP. A Flood Hazard Boundary Map was published for Custer County, South Dakota (Reference 9). This Flood Insurance Study is more detailed and, therefore, supersedes the Flood Hazard Boundary Map.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

8.0 BIBLIOGRAPHY AND REFERENCES

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3. Federal Emergency Management Agency, Flood Insurance Study, City of Custer, South Dakota, July 1980

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6. Horizons, Inc., Cross Section and Bridge Survey Data, Rapid City, South Dakota, 1984

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9. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Custer County, South Dakota, October 1977

10. Federal Emergency Management Agency, Flood Insurance Study, Pennington County, South Dakota, December 1981

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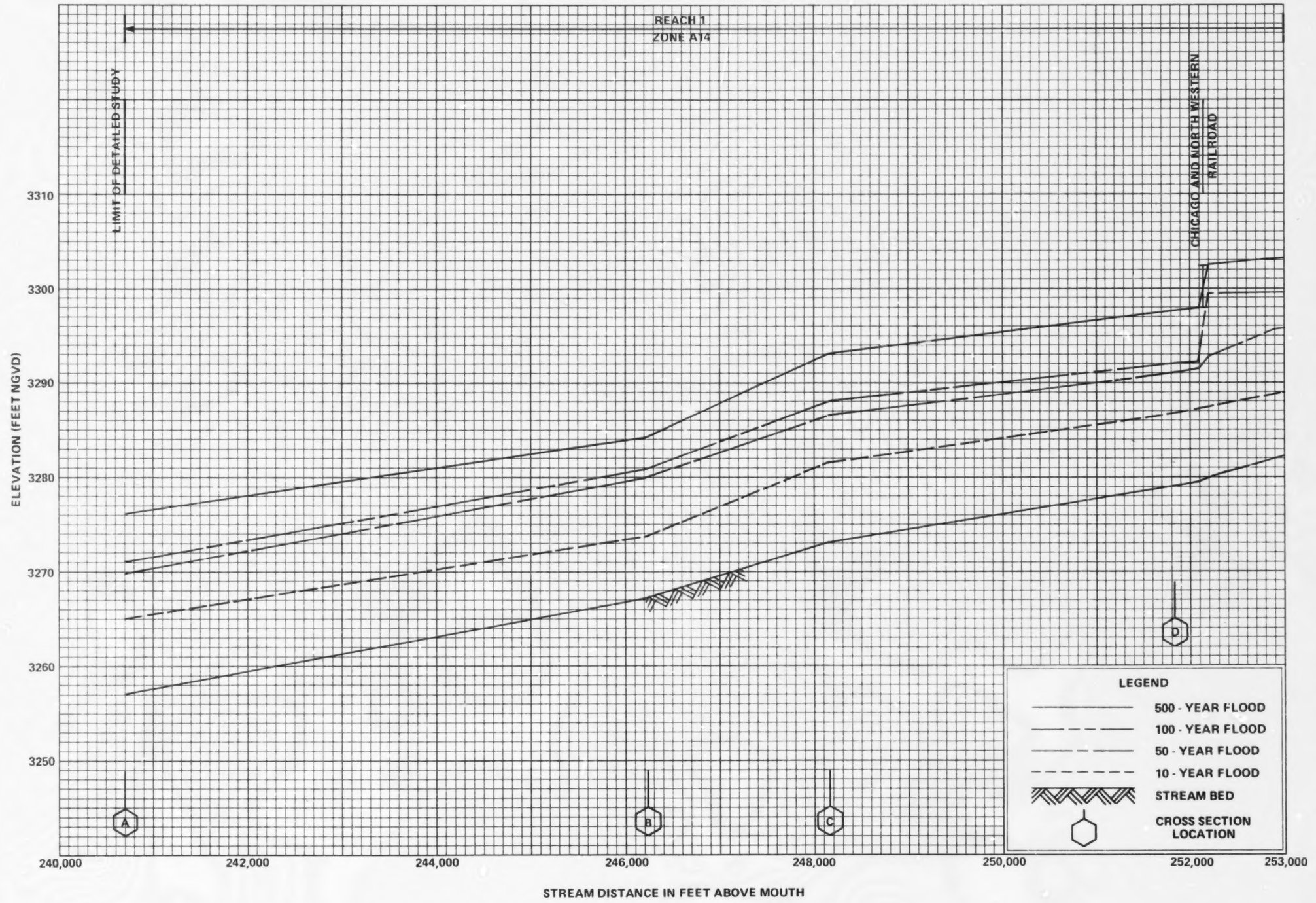

FLOOD PROFILES

BATTLE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

01P

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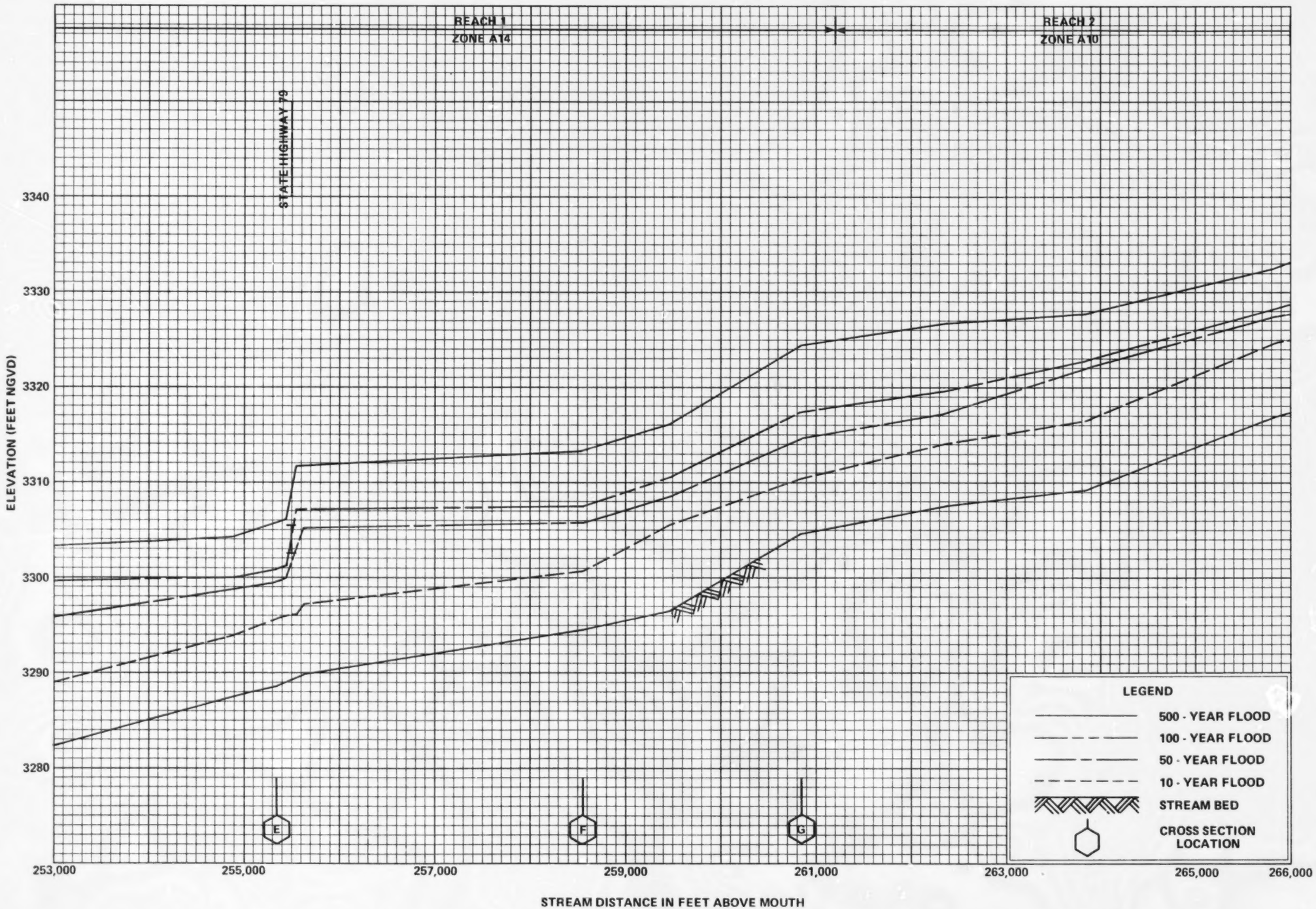

FLOOD PROFILES

BATTLE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

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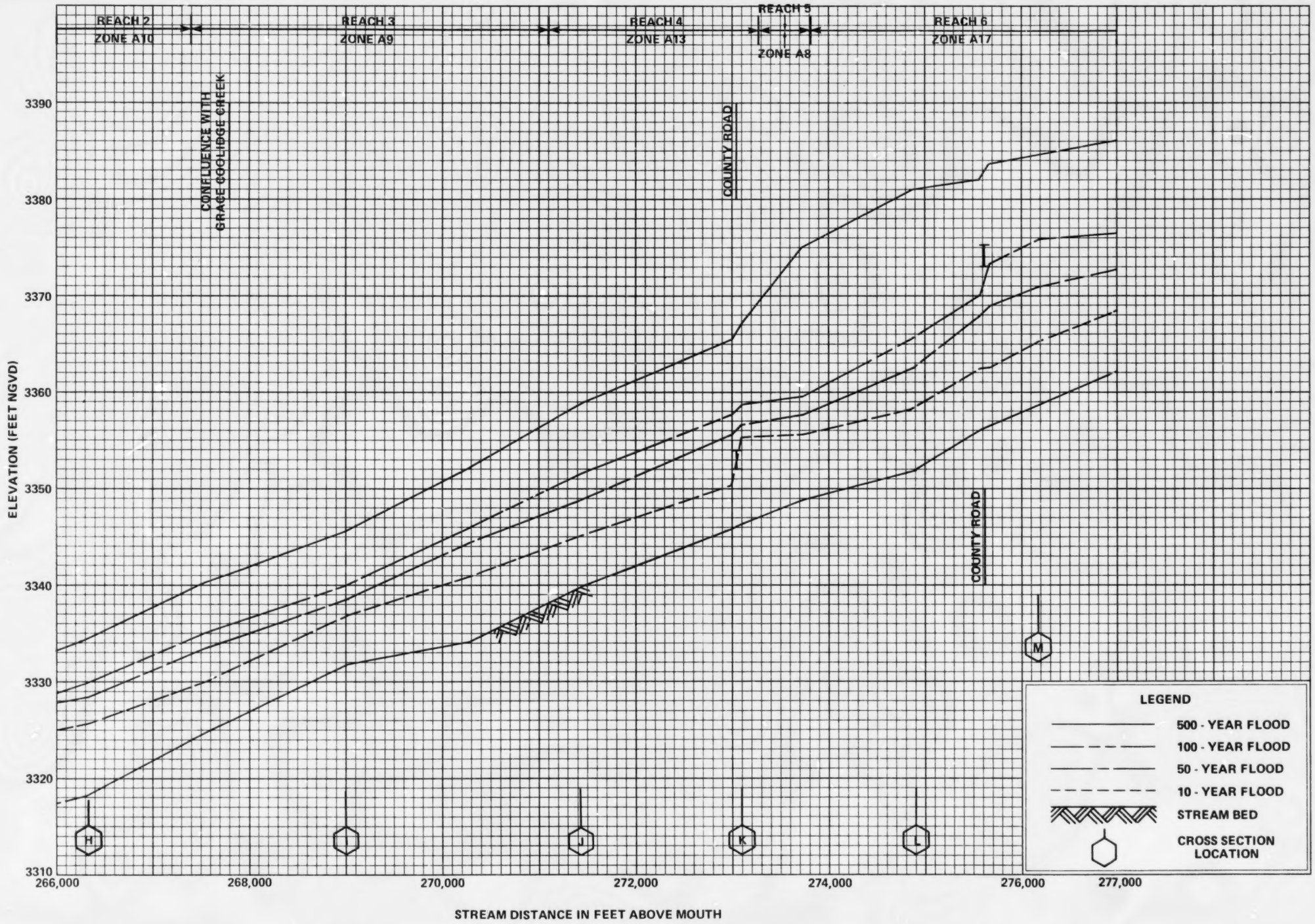

FLOOD PROFILES

BATTLE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

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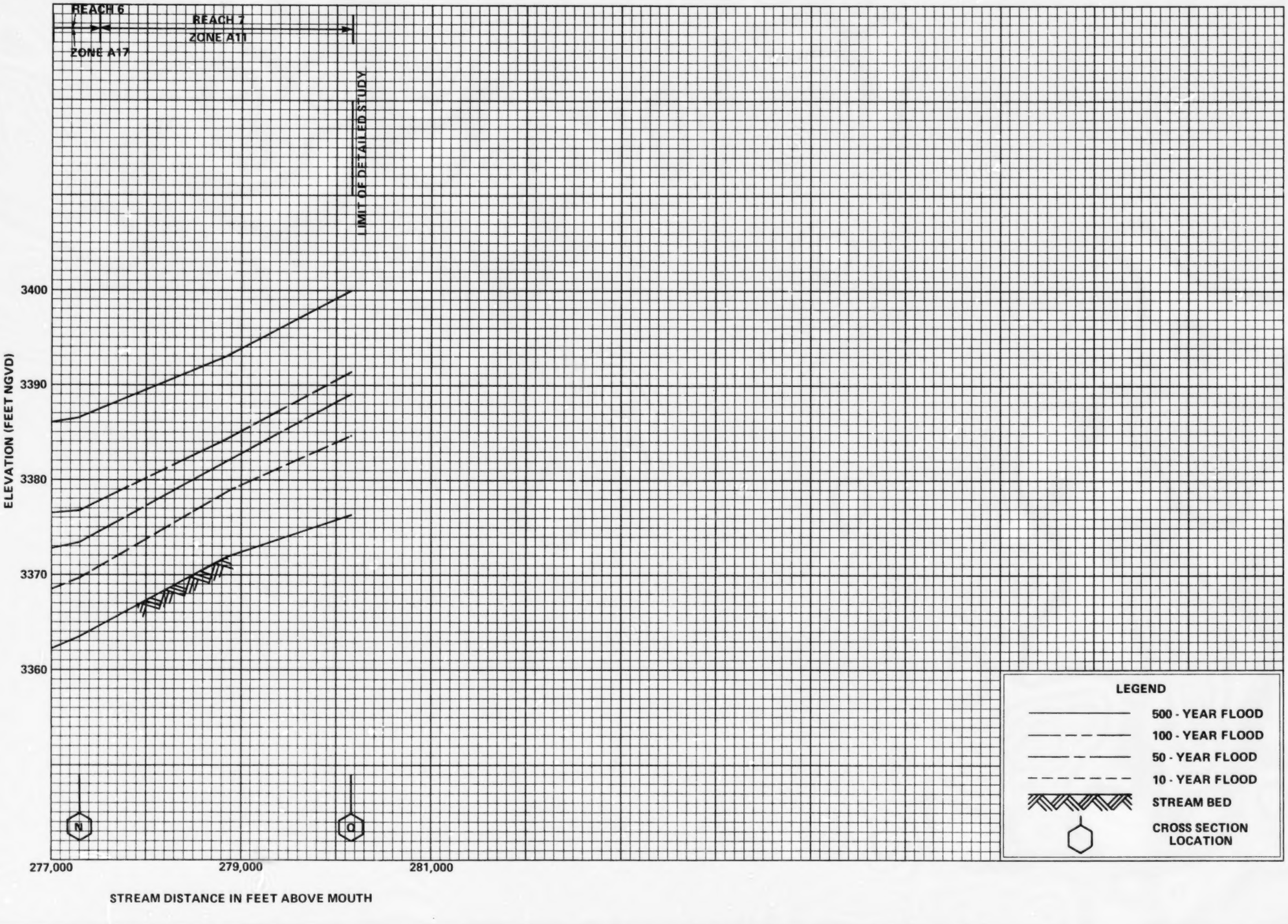

FLOOD PROFILES

BATTLE CREEK

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CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

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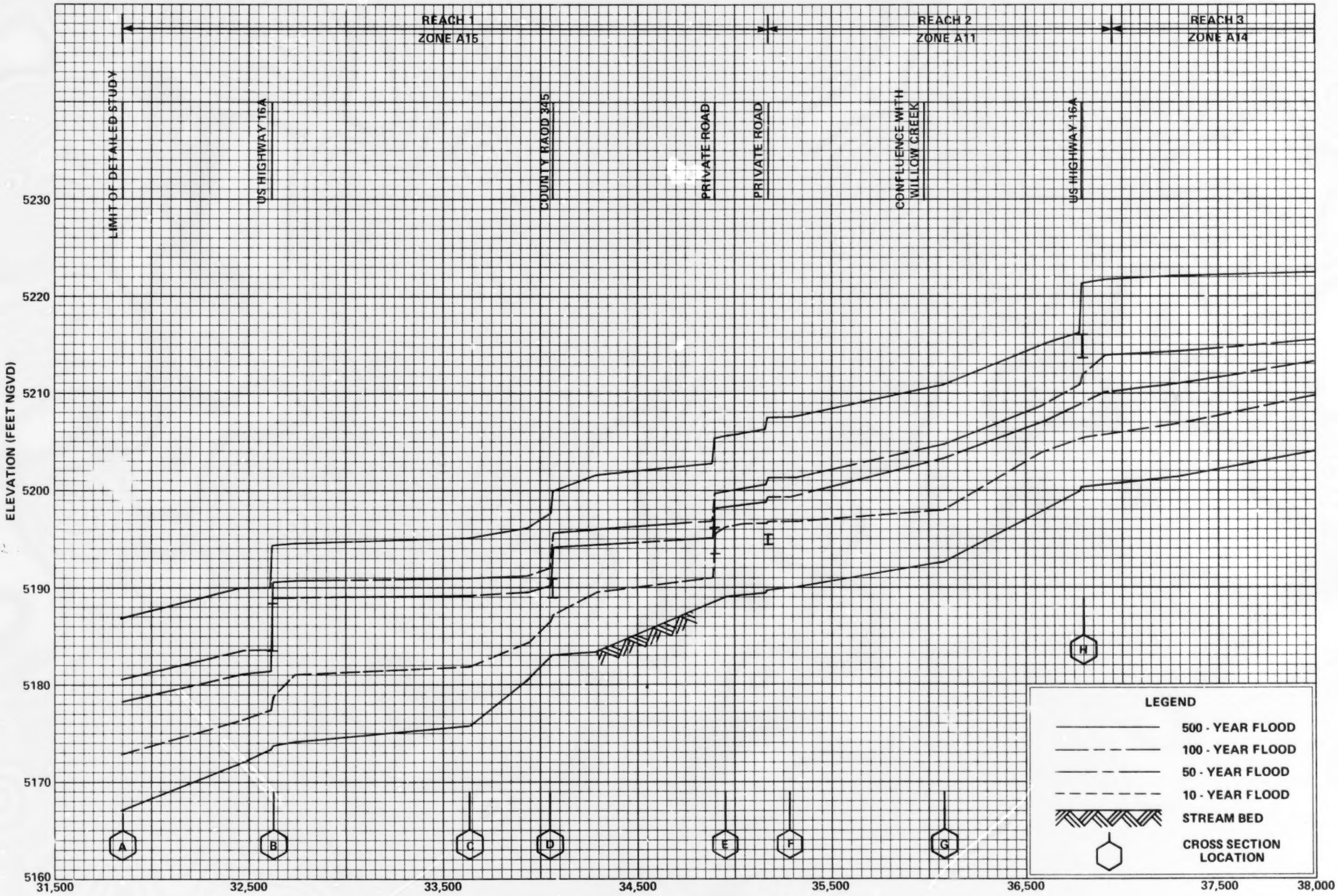

FLOOD PROFILES

FRENCH CREEK

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CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

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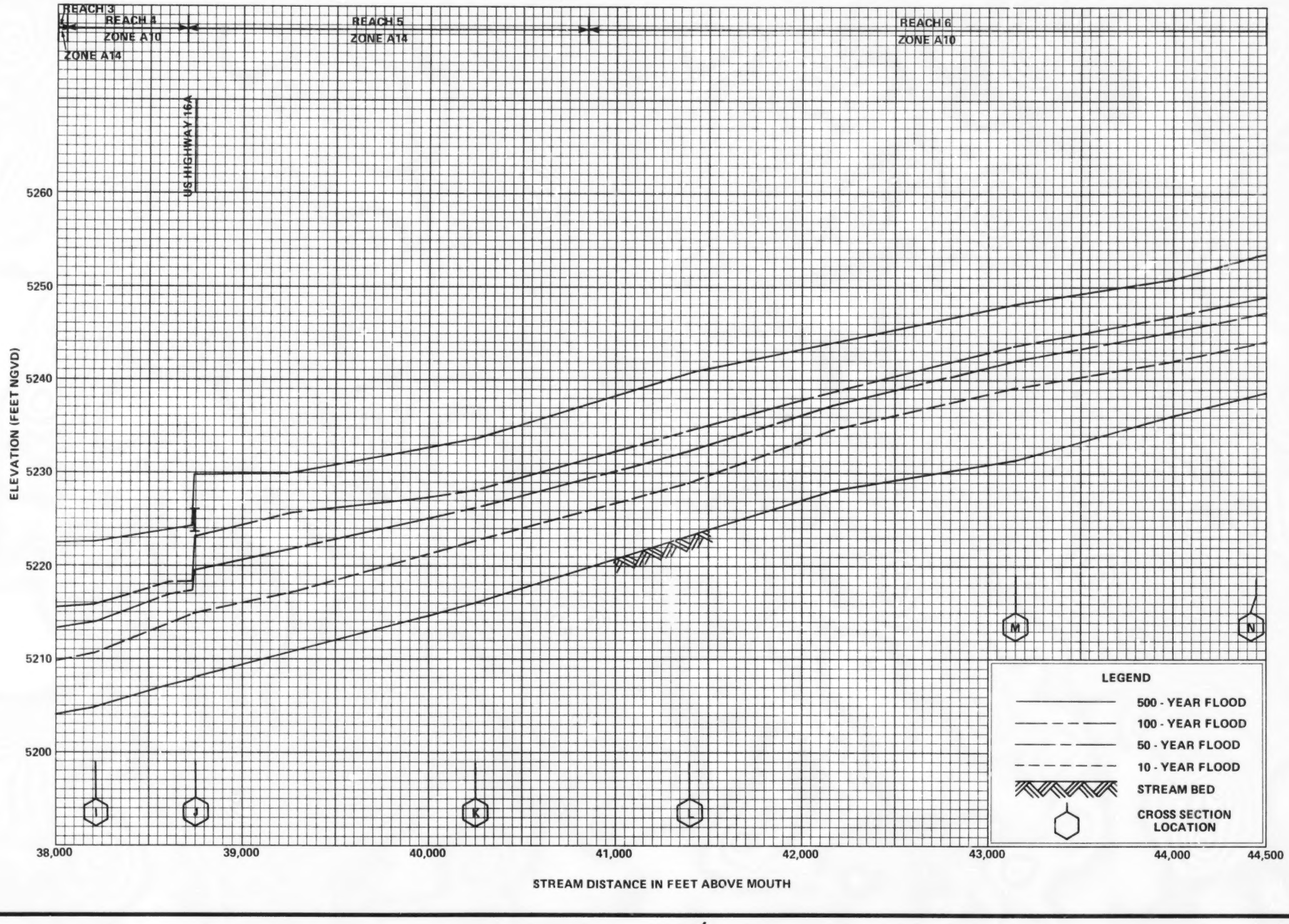

FLOOD PROFILES

FRENCH CREEK

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(UNINCORPORATED AREAS)

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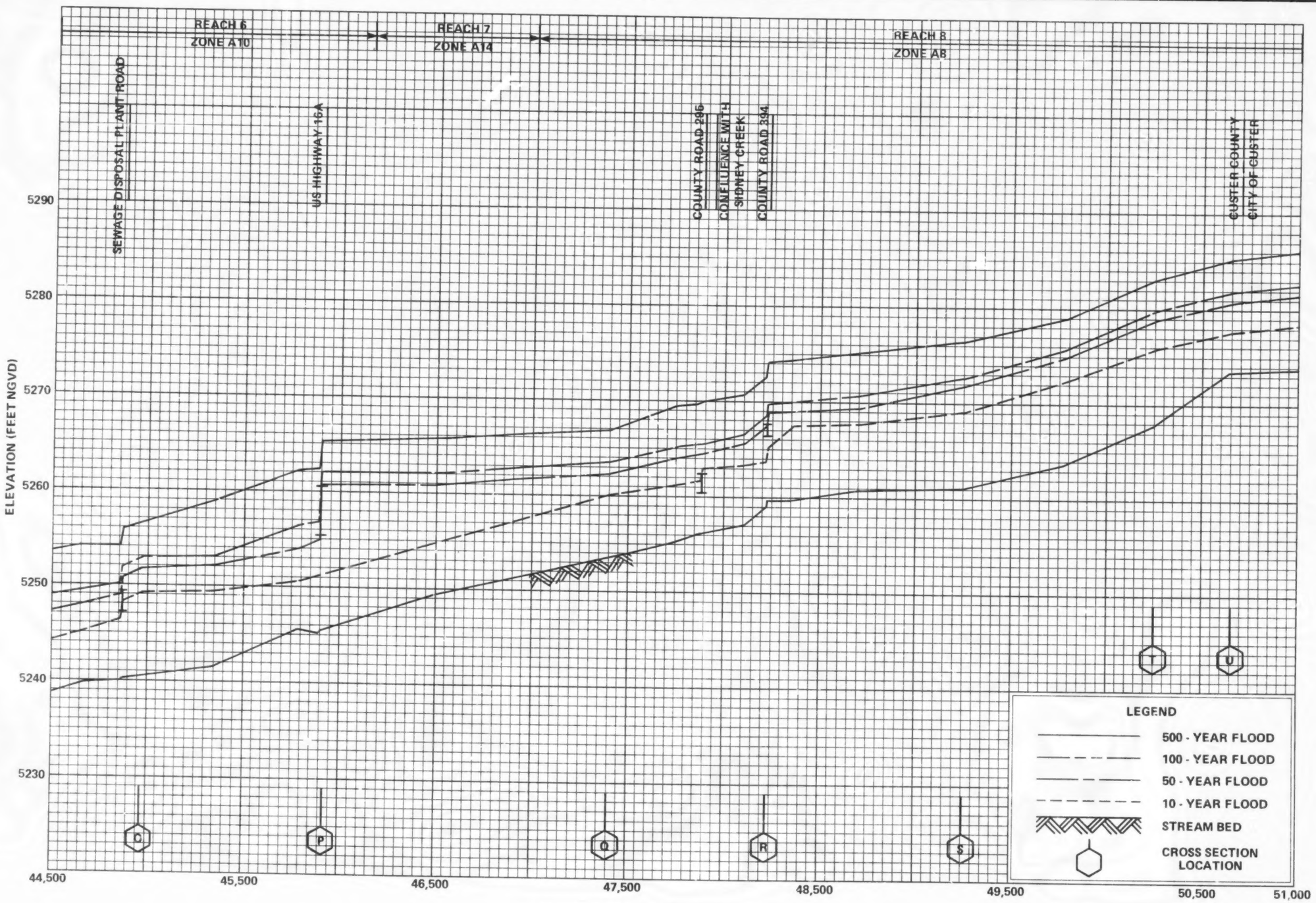

FLOOD PROFILES

FRENCH CREEK

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CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

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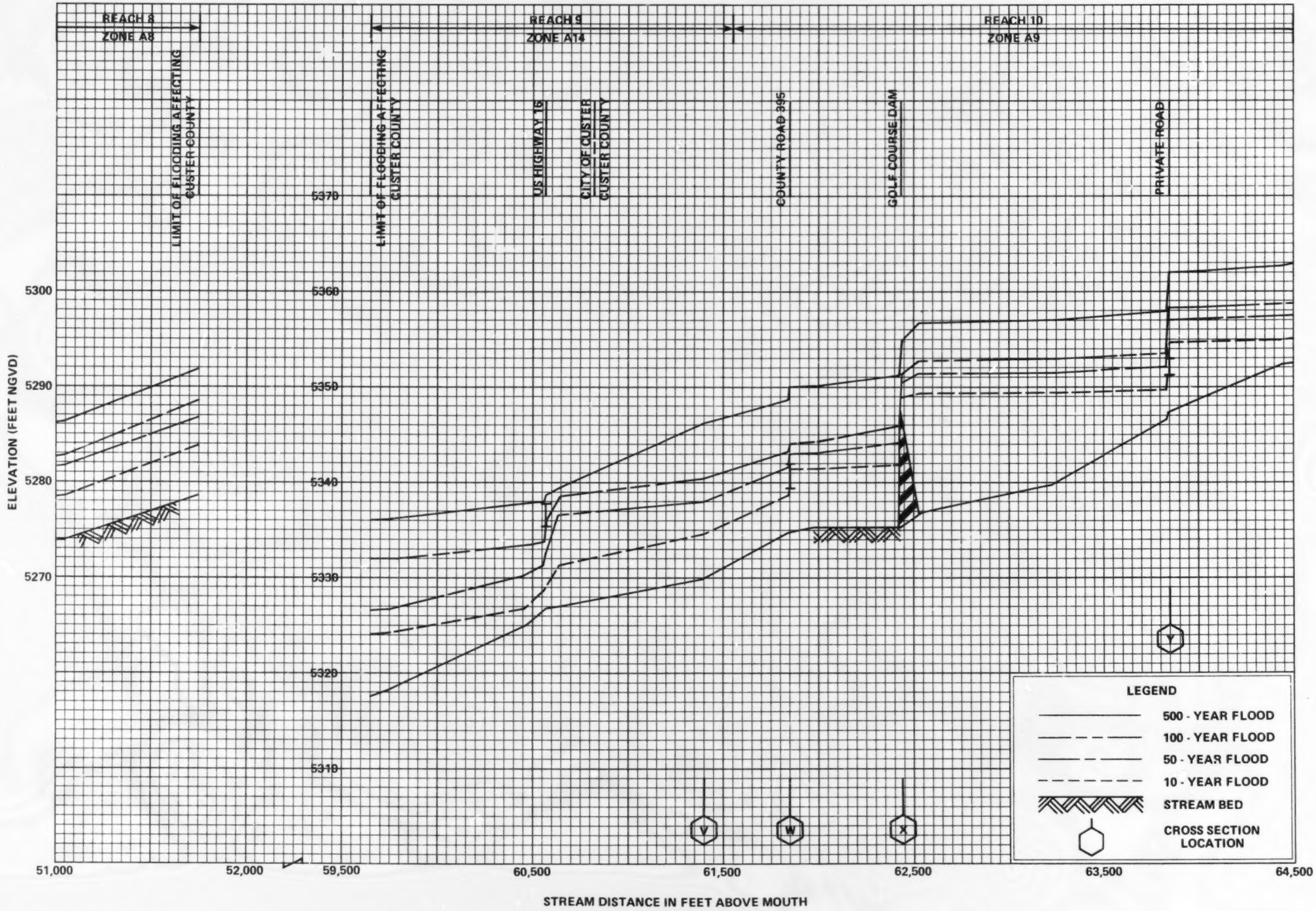

FLOOD PROFILES

FRENCH CREEK

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CUSTER COUNTY, SD
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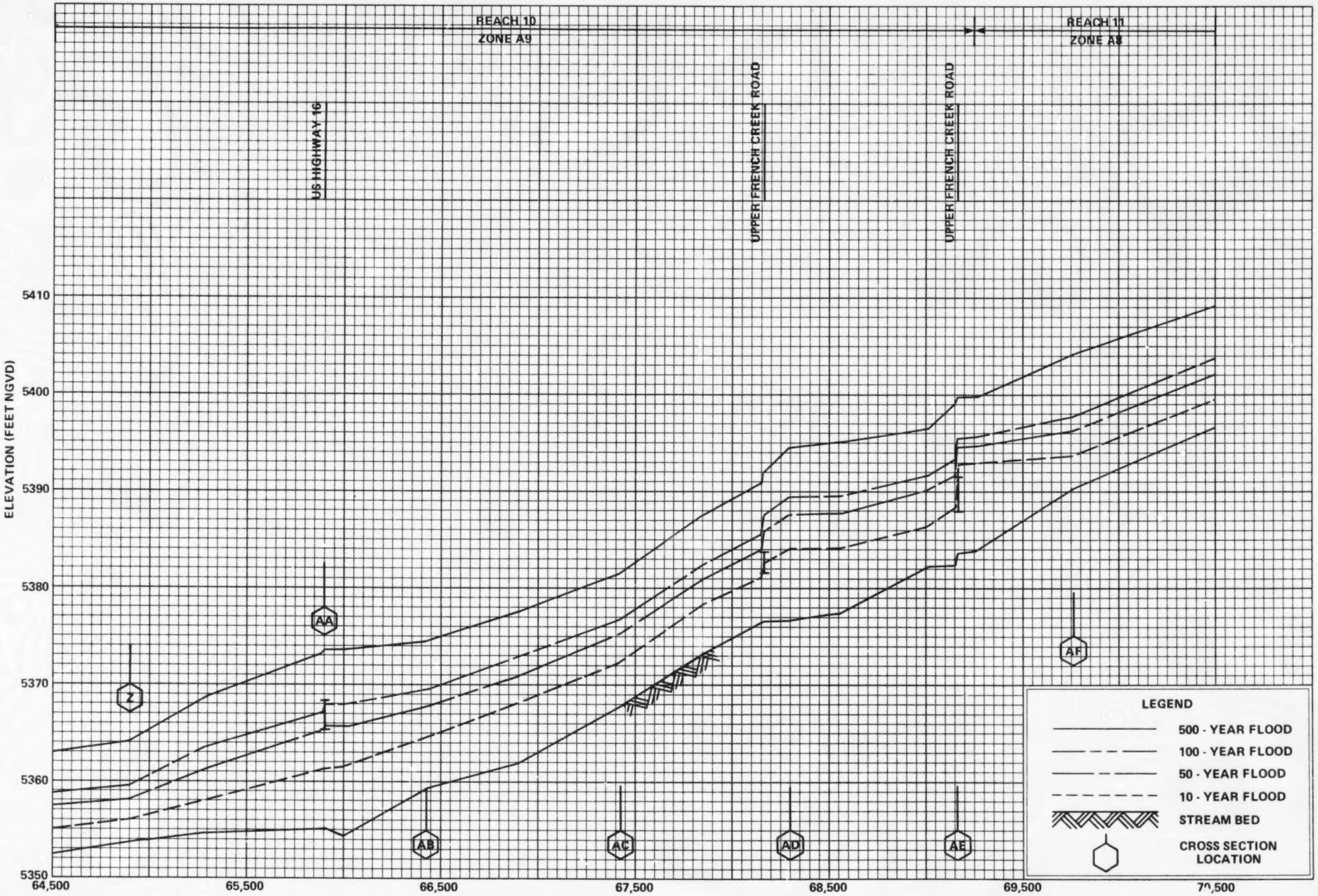

FLOOD PROFILES

FRENCH CREEK

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CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

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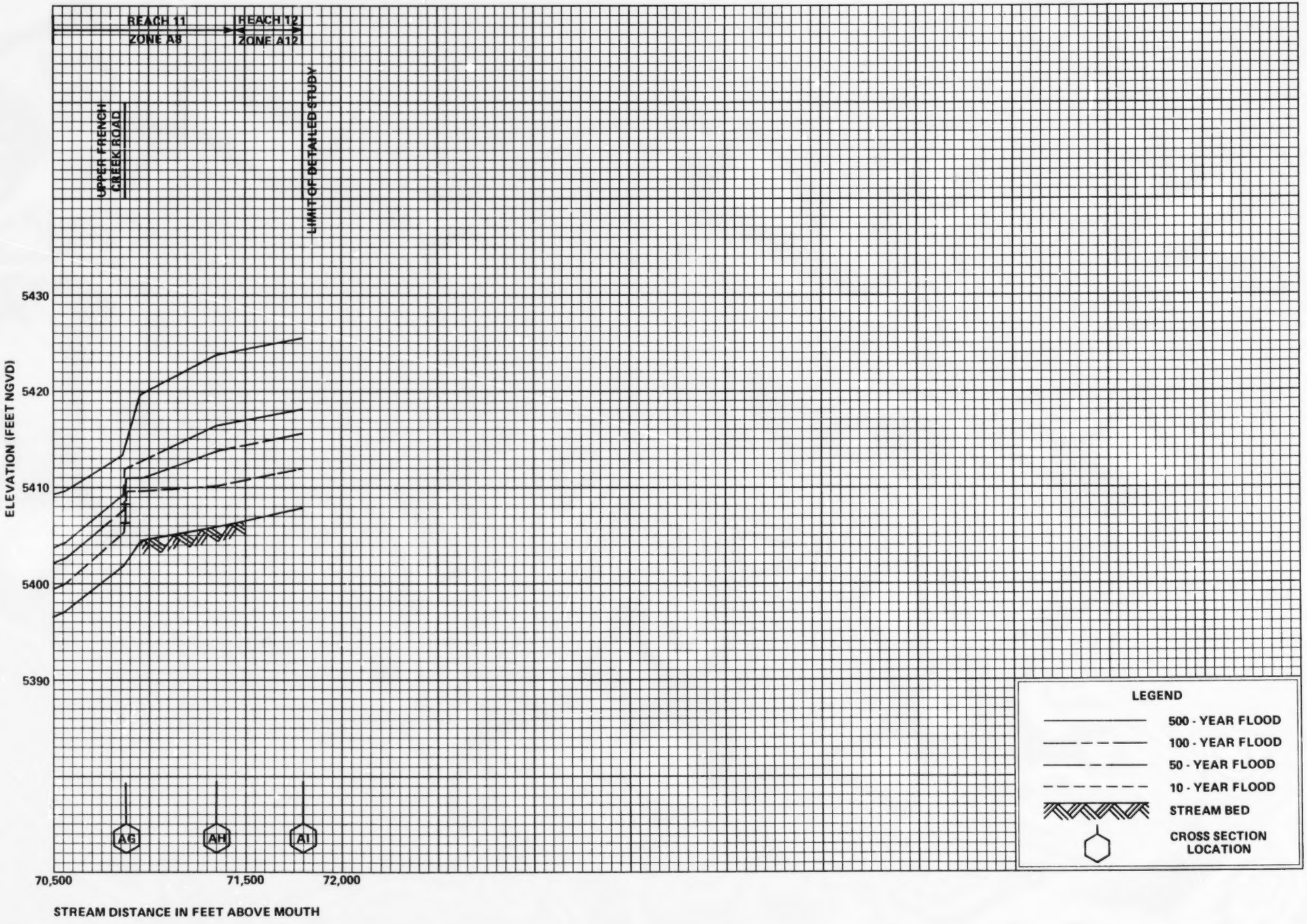

FLOOD PROFILES

FRENCH CREEK

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CUSTER COUNTY, SD
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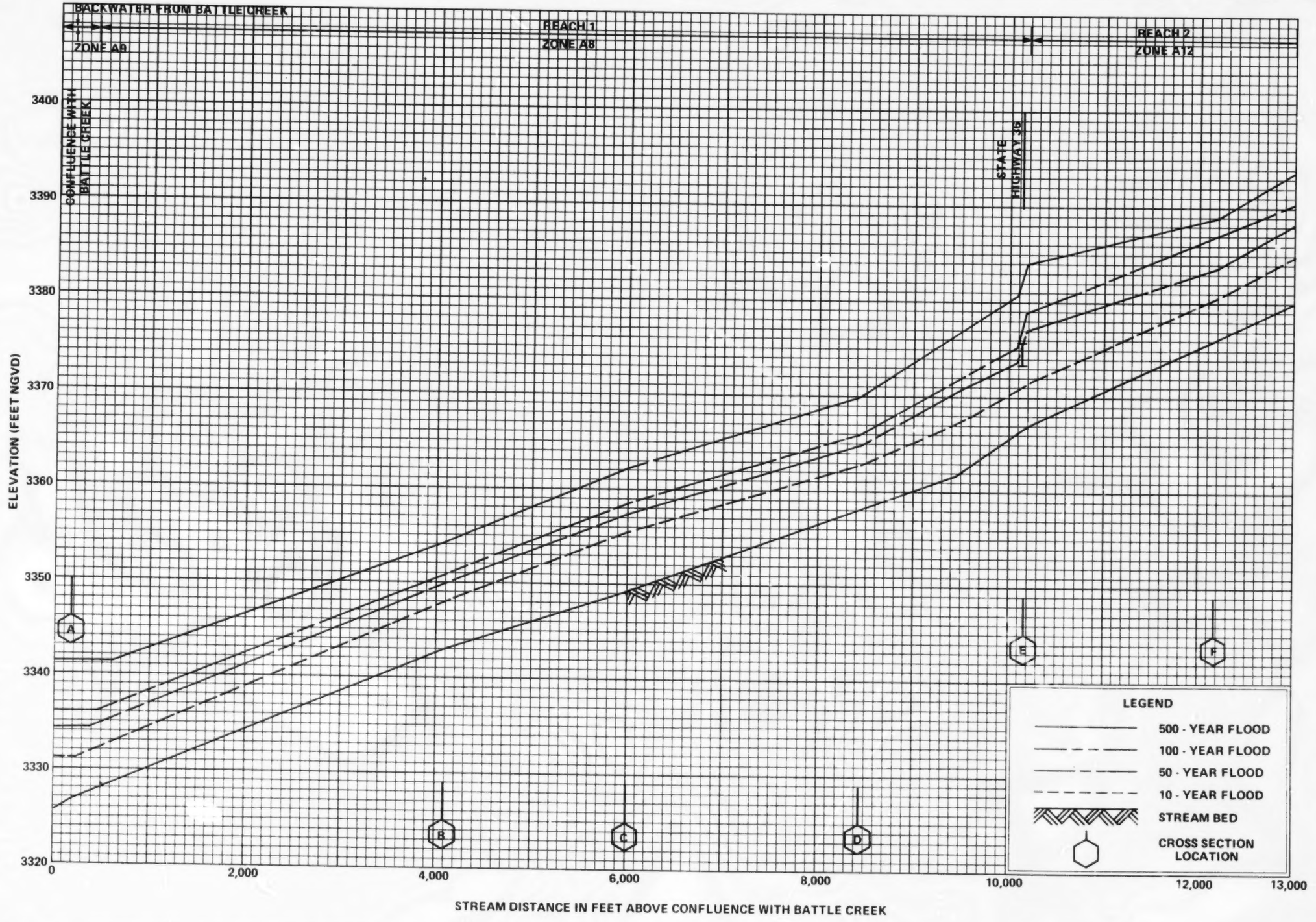

FLOOD PROFILES

GRACE COOLIDGE CREEK

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CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

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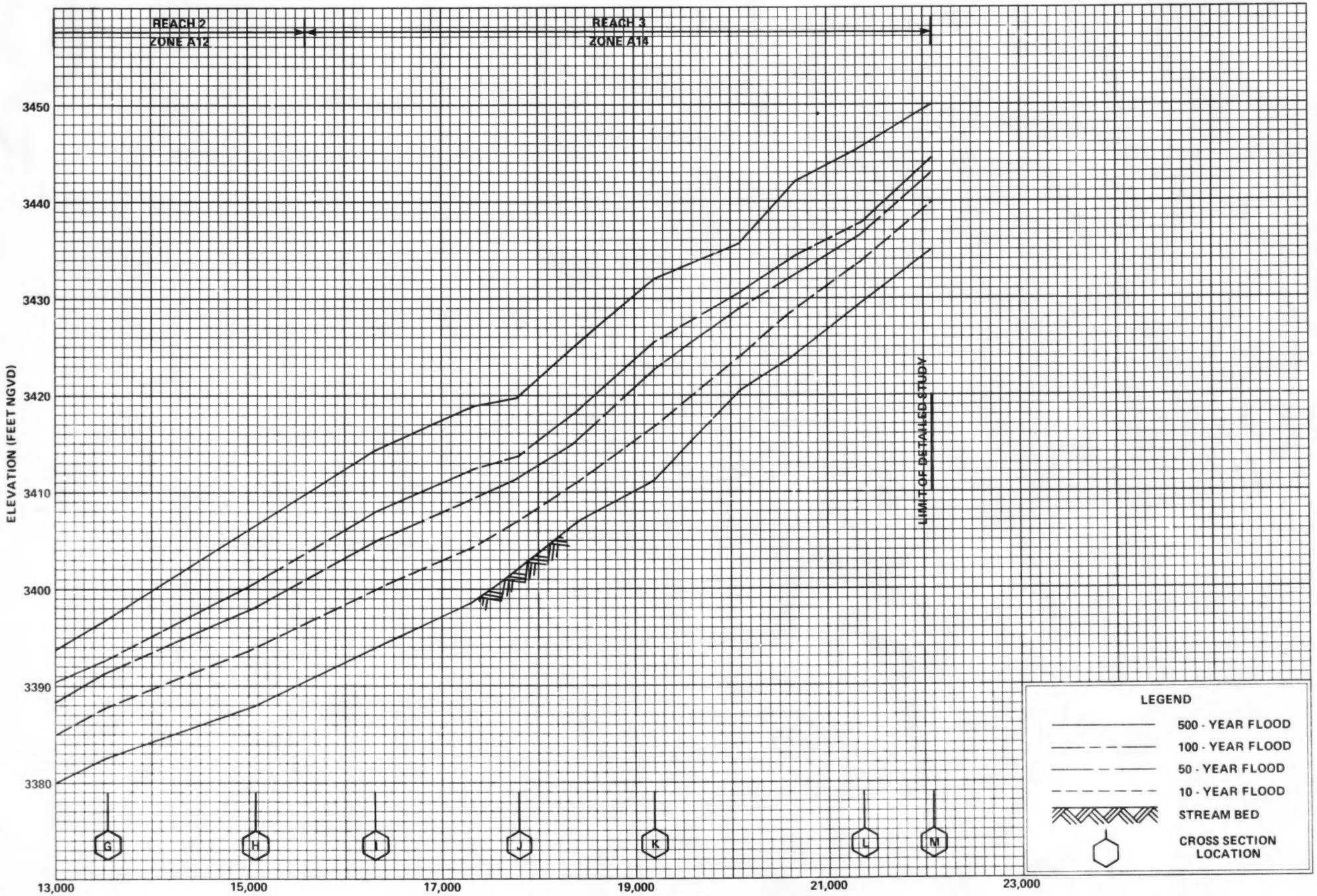

FLOOD PROFILES

GRACE COOLIDGE CREEK

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CUSTER COUNTY, SD
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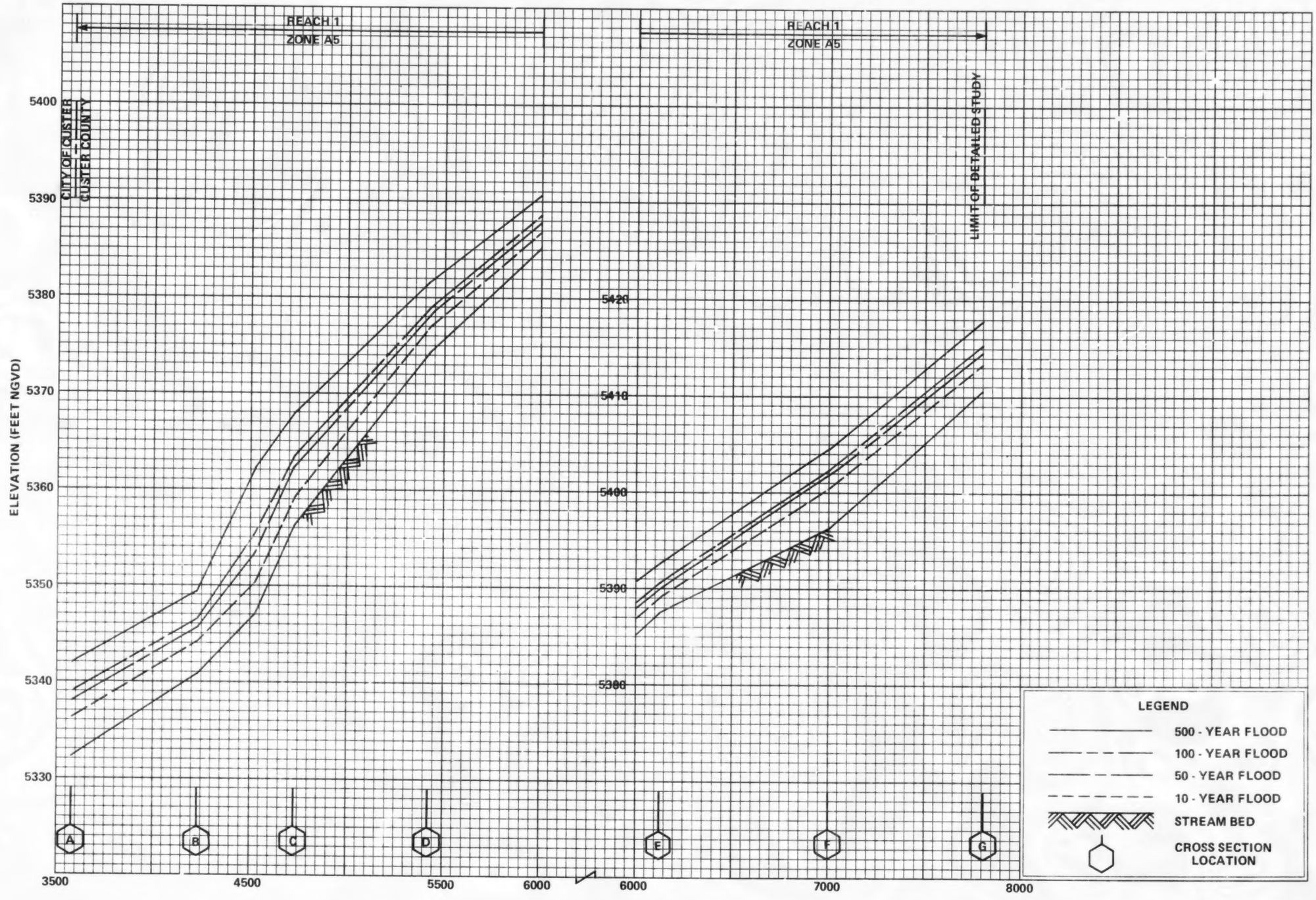

FLOOD PROFILES

LAUGHING WATER CREEK

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CUSTER COUNTY, SD
(UNINCORPORATED AREAS)

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